Critical thinking is not discipline-specific:
Teaching critical thinking to the beginning design student.

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It appears that beginning design students enter our design programs—irrespective of discipline—with an increasing handicap: the inability to think critically. Current pedagogical models in secondary education seem to favor rote memorization and regurgitation of facts in an effort to improve test scores. Even though test scores may be on the rise, "teaching for the test" inhibits the students' successful acquisition and application of useful, practical and professional knowledge and produces students who are, at best, nothing more than "fact containers."

In order to produce students who command a knowledge base more profound than that of disconnected facts, we must teach them the process of critical thinking. Just as Heidegger states that *learning* is the fundamental activity of mortals; it is equally true that *critical thinking* is the fundamental activity of designers. In terms of design, critical thinking is the means by which designers observe, learn, analyze and make decisions. Indeed, as designers, we are charged with improving the quality of life of the individuals and communities that use the places, objects and images we design. Therefore, we must give our students the ability to analyze the design challenge, its situation and its possible implications and to propose appropriate solutions. We must also teach our students ways to skillfully critique design, both their own and that of other designers in an effort to continually improve their design skills. Pedagogical methods focused on critical thinking equip the student with the ability to make sound, logical and appropriate decisions and to formulate a viable design process that is applicable to the design professions for which we are preparing them.

Critical thinking is the most interdisciplinary skill we could teach our students. As such, it does not uniquely belong to any one field; rather it is a property shared by all design professions. It is equally applicable in fields as diverse as architecture, graphic design, interior design, landscape architecture, industrial design, urban design and all forms of engineering.

Not only is critical thinking the most interdisciplinary design skill, it is also the most crucial. The act of *designing* is the natural offspring of the act of *deciding.* If we expect our students to achieve a level of sophistication in their design work, we must teach them to make good decisions during the design process. Good decision-making comes when a student is able to recognize and comprehend all the different facets of the situation at hand *and* to consider multiple possible solutions to determine which most appropriately addresses the situation. This emphasis on good decision-making and critical thinking should in no way limit the essential task of designers to one of problem solving. It should work with and augment the creative, intuitive spirit of design, by lending it structure, logic and rigor. Creativity, ingenuity and intuition are traits typically inherent in one's personality. As design educators our most effective method of teaching these traits to someone who does not possess

them naturally is to overtly model them in our own approach to design. It remains, therefore, that the primary role of the design educator is to engage the student in the more teachable traits of structure, rigor, insatiable questioning and the use of logic as a critical thinking skill.

Critical thinking as a tool for design and critique can be taught in various academic formats. Following are several specific academic venues in which critical thinking is currently taught in the beginning design studio, the beginning design graphics studio and the introduction to architecture/architecture appreciation course in the Common First Year Program of the College of Architecture and Planning at Ball State University. The evidence of critical thinking in each course is discussed in terms of both curriculum design and curriculum delivery.

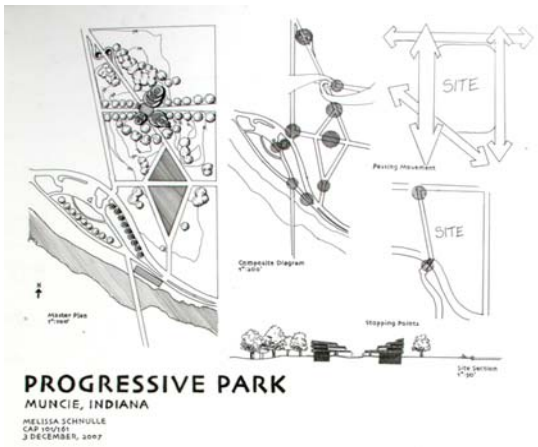
Teaching critical thinking in the design studio

It would be impossible to speak of the importance of critical thinking in beginning design education without discussing how it appears in the design studio, since the design studio is precisely where the student's ability for design is developed. Indeed, critical thinking should be at the core of the design studio curriculum and its delivery. As mentioned before, critical thinking is the process of observation, learning, analysis and decision-making. Following is a description of three studio projects realized in the 2007-08 academic year at Ball State University by first year design students in the College of Architecture and Planning.

The primary objectives of the first semester design studio at BSU are the design process, how to be a design student and the fundamentals of spatial design. After two initial curricular units that emphasize discovering order in design and spatial definition/enclosure, the third unit focuses in large part on observation, analysis and decision-making. It is the typical translation/abstraction project realized in many beginning design programs and it asks the students to translate a two-dimensional abstract or expressionist painting into a three-dimensional object and series of spaces. After a brief investigation of the painting's history, conception and impact, and after a two-dimensional graphic analysis of the painting, the student is asked to decide for him/herself which are the most important aspects of the painting and how they might translate these ideas into three-dimensional form. At left you can see Salvador Dali's painting *Geopoliticus Child Watching the Birth of the New Man* and the abstraction designed by BSU first-year student Laura Flores [Fall 2006] based on this painting. As is obvious, the intent of

this project is not for the student to produce a three-dimensional extrusion of the painting. Rather, it requires the student to *interpret* the painting as he/she sees fit. Ms. Flores' example is particularly strong in that she distilled the painting down to the issues which seemed most crucial to her: mortality/immortality, light/dark, transparency/opacity, solid/void and a new world order. She then used the three-dimensional abstraction to communicate these ideas. In terms of critical thinking, Ms. Flores had to first perceive for herself critical aspects of the painting; she had to analyze these aspects to understand their meaning and impact in the painting; and finally she had to choose which aspects were most important and how to best communicate them in three-dimensions.

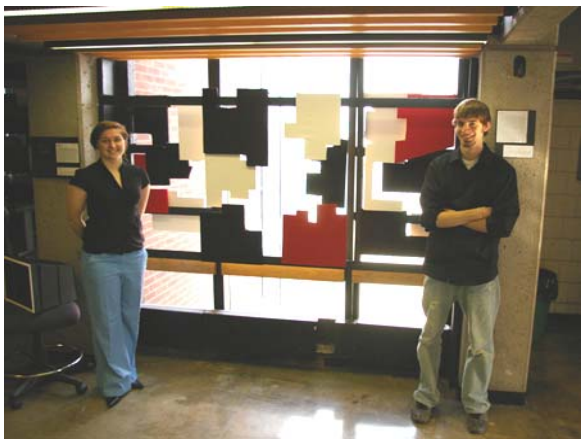
After this ground-level exposure to critical thinking, the fourth and final curricular unit of the first semester design studio gives the students a real place for analysis, understanding and response. The real place of this project is roughly analogous to the painting of the previous project: it is the catalyst for the critical thinking and decision-making processes. The place is typically a park setting near the BSU campus and students begin the unit by visiting the place multiple times [at various times of day and under different conditions], to take a detailed inventory of its built, natural, social and historical contexts. The students then determine for themselves the *genius loci* of the place and as a result suggest alterations that might be made to the place in order to highlight their idea of the place. The students are given a basic program of spaces [such as a gathering space, a moving space, a space for contemplation, etc.] to be included in the altered place and develop their designs through the typical process of experimentation and critique.



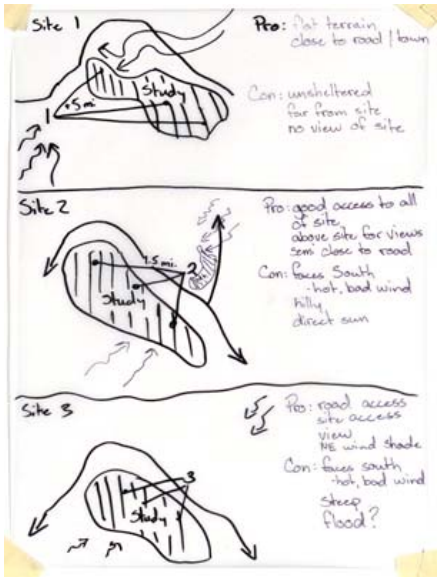
At left is the project designed by BSU first-year student Melissa Schnulle [Fall 2007]. Ms. Schnulle identified the *genius loci* of the place to be the convergence of two very different land uses: industrial and recreational, based on her observation of the context. She then chose to alter the place in such a way as to not only provide a smooth transition between these two very different land uses, but also to cause the visitor to notice and reflect on these two uses and their apparent asymmetry. In so doing, Ms. Schnulle exercised her critical thinking skills by observing the place, distilling from it the most critical aspects and choosing how best to represent these aspects as she altered the place.

In a similar project at the beginning of the second semester design studio, students are again asked to observe, analyze and respond to a real place. This unit reiterates and further refines the critical thinking skills introduced in the first

semester design studio, however, this time, the real place is a small interior space and the students are eventually required to construct a full scale intervention in the space that reveals their observation and analysis of the place. They are also required to work in pairs, thus introducing the importance of teamwork and consensus decision-making.



At left is the space [inside BSU's College of Architecture and Planning] analyzed by first-year students Fiona Cahill and David Heilman and the intervention they constructed. The space is dominated by the only window in their design studio, which they understood to be their link with the outside world. They also noticed that the *genius loci* of the space changes with the diurnal cycle, morphing from an extroversive space during the day [when reflections on the glass are minimal] to an introspective space at night [when reflections on the glass prohibit views of the outside]. They then designed and constructed an apparatus installed at the location of the window that could be modified by the visitor. The puzzle-piece panels slide independently of each other to obscure or reveal the view through the window as the user sees fit. This project represents Mr. Heilman's and Ms. Cahill's development of their critical thinking skills as they successfully analyzed the place, interpreted it and designed the installation to reveal their interpretation. They also practiced their decision-making skills as they had to discuss their observations with each other and arrive at a consensus.



The following unit in the second semester of design studio also emphasizes the relevance of critical thinking skills in the design process. This unit focuses on issues of natural/climatic systems, appropriate response to harsh environmental conditions and fundamentals of sustainable design. The students design a scientific research station for a site with extreme climatic conditions. Ryan Anderson, BSU first year design student [Spring 2008] was given Death Valley as his location. After initial research of Death Valley and an organism that thrives in this climate, the first task was to select an exact site appropriate for a scientific research station. In this selection process [some of which is shown graphically at left] Mr. Anderson demonstrated high levels of critical thinking. He identified several contextual factors such as topography, wind, sun and human use patterns that inevitably influence the site and orientation of a research station in Death Valley. He then chose nine potential sites in Death Valley and studied each site, weighing its pros and cons and eventually identifying one site as most appropriate. At left is a series of analytical diagrams that helped Mr. Anderson logically decide which site was best suited for a research station.

While it remains that the design of the beginning design curriculum is crucial to teaching critical thinking, it is also vital to consider the delivery of this curriculum. Following are a few methods employed by the author to encourage critical thinking among students in the design studio.

- While students typically prefer individualized desk critiques, it is the author's experience that group critiques are inevitably more successful and enriching to the students' critical thinking abilities. In most individualized desk critiques the professor typically takes the role of instructor, making observations and giving suggestions which the student then follows without further consideration. Contrarily, in group critiques, where the professor assumes the role of discussion facilitator, students are required to take on the role of critic, as they analyze, discuss and make suggestions for their classmates' design projects. In this way, the individual student does not simply follow instructions, but engages in the higher level of thinking required for critique.
- Final, formal reviews at the end of each project [complete with a panel of guest critics] are vital; however it is also helpful to include a student or two from the "peanut gallery" on the review panel. While beginning design students are always reluctant to comment on a classmate's project, especially in the company of guest critics [faculty and practicing professionals], it requires them to keep a critical mind, even in the final stages of the project. The author typically calls on a different student "volunteer" for each presenter so as to not overburden any particular student and to ensure that each student is fully engaged in the review.
- As students analyze design [both their own and that of others] it is important to push them beyond a simple inventory of elements or aspects of the design. They should begin to evaluate these aspects, determining which are most

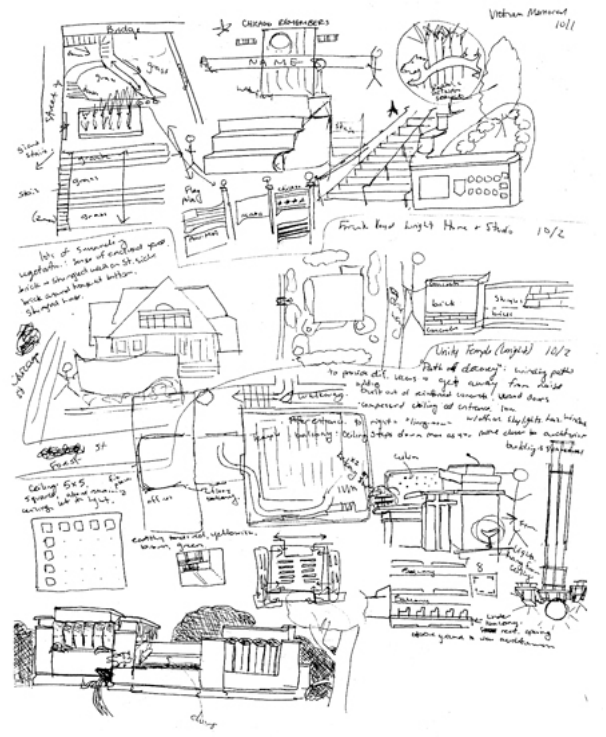
successful and, of course most importantly, *why* these aspects are successful [or unsuccessful]. Unless the student asks *why* he/she will not fully understand how to apply this knowledge to his/her own design process.

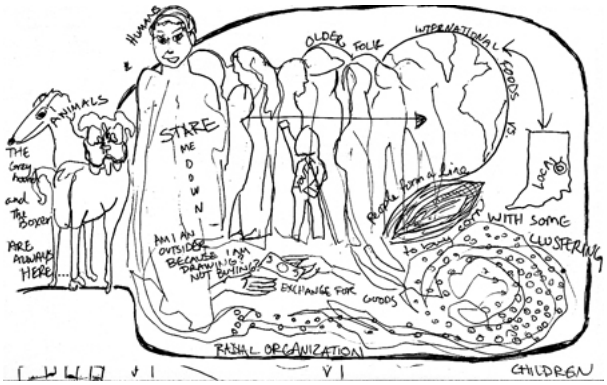
- It is often helpful to the student when the professor explains the project expectations, goals and evaluation criteria very clearly. Doing so gives the student direction and helps him/her achieve the objectives of the project. However, sometimes the didactic approach prevents the student from exploring multiple alternatives and making his/her own decisions. Therefore, it is sometimes most beneficial in the long run if the professor leaves expectations fairly vague. Obviously, the beginning design student prefers concrete directions. However, the author often tells his design students "Right now I am speaking in vague terms to allow you the opportunity to make your own decisions." Again, decision-making is a vital part of the critical thinking process.

Teaching critical thinking in the design graphics/communication studio

Since critical thinking remains such a vital task in the design process, it is obvious that teaching critical thinking would occur within the design studio setting. However, the design studio does not hold exclusive rights to critical thinking. Design graphics and design communication are inseparable components of the design process and thus also employ critical thinking skills. Following is a description of two graphics projects taught at the beginning design level that incorporate critical thinking.

One project, taught in both the undergraduate and graduate graphics courses at BSU follows Paul Laseau and Norman Crowe's book *Visual Notes.* Students are encouraged to observe, analyze and evaluate the places they visit, both real and imaginary and to record their observations in a graphic format that can serve as reference to their present and future design processes. Sometimes the project involves recording an imagined place, such as a place the student experienced in a dream; other times the student observes and records a place he/she has visited, either on a site visit, field trip or on a daily basis. The purpose of taking visual notes is not solely to capture highly artistic images of the place [although these can be useful]; rather it is to teach the students how to understand a place critically and, more importantly, how to apply that knowledge to their design process.





At left are reproductions of pages from student sketch books showing their ability to record visual notes. At the time, Dawn Baker was a first-year undergraduate student [Fall 2007] and Clare Ros was a first-year graduate student [Summer 2007] beginning her first professional degree in architecture. As is obvious from the sketches, the emphasis is not on creating museum-quality sketches; rather the objective of the visual notes assignment is to make the student comfortable with observing, analyzing and recording his/her perceptions and opinions about the places he/she visits. Inherent in the visual notes process is the act of decision-making, as each student must decide which elements/aspects of the place are important enough to be recorded. The student must also decide which drawings most effectively communicate and record those aspects. Again, as the student makes choices, he/she is required to make critical evaluations of the place.

Even the more fundamental graphic skills can be taught in ways that emphasize critical thinking. After several iterations of teaching one- and two-point perspective in the traditional, constructed manner, the author has discovered that these methods lead most students to believe that perspective drawings can only be useful as post-production presentation tools. Therefore, in order to encourage students to understand the utility of perspective drawings *as part of* the design process, the author has developed a method of teaching perspective that employs critical thinking and effectively turns the traditional process of perspective drawing on its head. Students begin to conceptualize the space drawing only in perspective and then test the scale, proportion and depth of the space using plans and sections. Often, students will return to and modify the perspectives once they see the true scale and proportion of the spaces in plan and section. Not only does this method teach the students that the various drawing types are interrelated and mutually informing, it also encourages the student to see the relevance of critical thinking in drawing and design communication as he/she continually observes, evaluates and makes decisions about the drawings. In this way, there is never a point at which the student turns off his/her critical thinking skills. It encourages a constant cycle of questioning, evaluation, critique and improvement.

As with the design studio, it is important to develop ways to deliver the curriculum that reinforce critical thinking in the design graphics/communication studio. In both individual and group critiques, the author often follows a method developed by Arthur Schaller, Architecture Division Head at Norwich University. In critiquing the drawing, the professor asks the student, *"What is your favorite square inch of the drawing, and why?"* Sometimes it is also helpful to ask the student which square inch is his/her least favorite and, of course, why. Similarly, the author also typically uses the group critique to initiate critical thinking. After all students pin up their final drawings, the professor calls on a volunteer from the class to evaluate a classmate's drawing. It is important here to encourage the student to recognize both strengths *and* weaknesses by asking the volunteer to identify one successful aspect of the drawing and one area for improvement. Furthermore, it is helpful to push the point further by asking the volunteer to suggest specific ways in which the drawing could be improved. In the situations mentioned above, requiring the student to evaluate and make choices gives the student clear direction on how to improve the product. Most importantly, the student learns to apply the critical method to every task.

Teaching critical thinking in the architecture appreciation course

In order to truly instill in the beginning design student the importance of critical thinking, it should be taught in all courses, not only the studio courses. In addition to design, the author also teaches survey courses in architecture. Following is a description of projects designed with the specific intent of teaching critical thinking in the lecture-format architecture appreciation course.

In this course students are exposed to the work of a handful of important architects of the 20th century, such as Frank Lloyd Wright, Mies van der Rohe, Le Corbusier, etc. The culmination of this curricular unit is an in-class essay in which the student compares and contrasts a pair of buildings of similar function designed by different architects. The compare/contrast format is uniquely suitable for teaching critical thinking in that the student is required to observe similarities and differences as well as strengths and weaknesses of each building and is encouraged to look deeper than that which is readily apparent. The substance of this essay is not a mere report on a famous building; rather it is the critical analysis in which the student observes and compares the varied approach each architect takes to the chosen building type.

The overriding theme for this architecture appreciation survey course is the question *"What is Architecture?"* By repeatedly asking this question, the course helps the individual student develop his/her own definition of architecture and a model by which he/she evaluates and critiques architecture. The next curricular unit provides two opportunities for the student to experiment with already established models of architectural critique which are presented to them in detail. The first model critiques architecture by examining the response it gives to its contextual setting. In this project, students analyze the context [natural, built, functional, and cultural, etc.] of a building which has not yet been built or is currently under construction. Without seeing the design for the building, the students are instructed to observe the context and make suggestions for how the building could respond to these contextual issues. They are then shown the design for the building in detail and are required to write a critique of the ways in which it responds to its context.

The second model translates Martin Heidegger's concept of the Fourfold [from his essay *Building Dwelling Thinking*] into architectural critique. After an initial introduction to Heidegger's Fourfold [reading the article, lecture and discussion] students are assigned two spaces on the BSU campus of similar function [i.e. two lobbies, etc.] to serve as subject matter for analysis. In pairs, the students observe the two spaces and critique them according to Heidegger's Fourfold. The crux of this learning experience is the last step, in which the student team is required to choose which of the two spaces *best represents* the Fourfold, followed by a detailed explanation of *why*. These two projects [contextual analysis and critique according to Heidegger's Fourfold] emphasize critical thinking in that they encourage observation and analysis and require the student to make crucial decisions regarding the relative strength or weakness of the design of the buildings they have studied.

The final component of the architecture appreciation survey course is another in-class essay in which the students answer the question *"What is Architecture?"* In essay format they are expected to clearly state their own viewpoints and to adequately support their argument using specific examples. Even though this essay is essentially a position paper, it is not evaluated on *what* position the student takes; rather it is evaluated on *how well* the student explains his/her position, *how well* the position is supported and *how applicable* it is to the student's own design process. The final essay question is announced on the first day of class so the students have the entire semester to consider their answer. Additionally, the author has found it successful to allow students to submit preview drafts for review by the professor if they so choose. This preview process helps eliminate the initial confusion and doubt surrounding such an essay question and the professor is able to help the student build confidence in the student's own views. Ultimately, this essay is successful in teaching critical thinking, in that it sharpens the student's ability to make logical, rational and informed decisions regarding design. It also teaches them that it is acceptable and even necessary for a designer to be able to take a stand on issues related to his/her profession.

In terms of delivery, the architecture appreciation survey course teaches critical thinking by utilizing methods that encourage and require careful observation, insightful analysis and logical decision-making. The most successful part of these projects is when the student is asked to decide which of the buildings best responds to its context, or which building best follows Heidegger's Fourfold, or to decide for himself/herself the meaning of architecture. Since these teaching methods so closely focus on formulating logical, rational and supported arguments, it is important that the professor demonstrate in a clear manner ways to successfully support an argument. The author has found that it helps the students when he demonstrates in-class how to form a well developed and supported argument by critiquing a building according to the models the students have been assigned [context, Fourfold, etc.].

To conclude

The process of observation, analysis, learning and decision-making is inherent in the act of designing; therefore critical thinking is the most important skill any designer can master. For this reason, it is crucial that critical thinking be present both overtly and subliminally in the curriculum design and delivery for beginning design students. The abovementioned projects and delivery methods are only a small representation of the many ways critical thinking can be taught to the beginning design student.

The author certainly welcomes feedback and suggestions for additional means of teaching critical thinking.

Just as it is necessary to teach critical thinking to the beginning design student, it is equally important to continue teaching critical thinking throughout the design curriculum and beyond the foundational stages. It is not a skill that can be perfected in one academic year; rather it often takes a lifetime to develop. Our goal as beginning design educators is to set our students on the path of critical discovery and decision-making that will guide them through their professional careers and be useful in their own design processes and, ultimately, be useful to the people for whom they design.

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